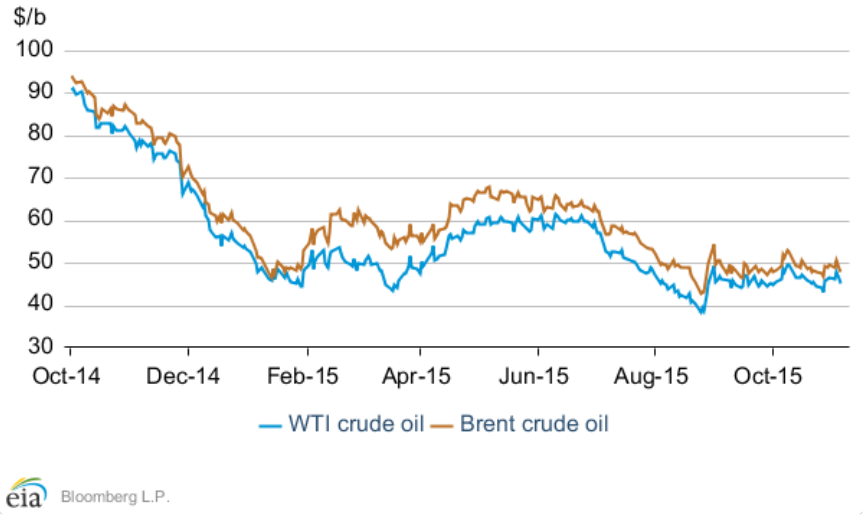
Short-Term Energy Outlook
Market Prices and Uncertainty Report

Crude Oil

Prices: Crude oil prices remained within the range established over the previous three months. The North Sea Brent front month futures price settled at $47.98 per barrel (b) on November 5, an increase of $0.29/b since October 1 **(Figure 1)**. The West Texas Intermediate (WTI) front month futures price settled at $45.20/b on November 5, rising by 46 cents/b over the same time.

Figure 1. Historical crude oil front month futures prices



Although prices were relatively stable, large uncertainty remains in the crude oil market, as upside and downside risks to supply and demand still exist. U.S. oil-directed rig counts continue to decline, but the effect on the overall U.S. production in the past few months is unclear. The timing and volume of future, additional production from several international producers, particularly Iran and Libya, is also uncertain. On the demand side, projections for low GDP growth in the fourth quarter highlight the downside risk to petroleum product demand going forward. Even with non-OPEC production projected to decline in 2016 compared to 2015, demand growth is an important factor to reduce inventory builds and help bring the global oil market more into balance.

This is a regular monthly companion to the EIA *Short-Term Energy Outlook* (http://www.eia.gov/forecasts/steo/)
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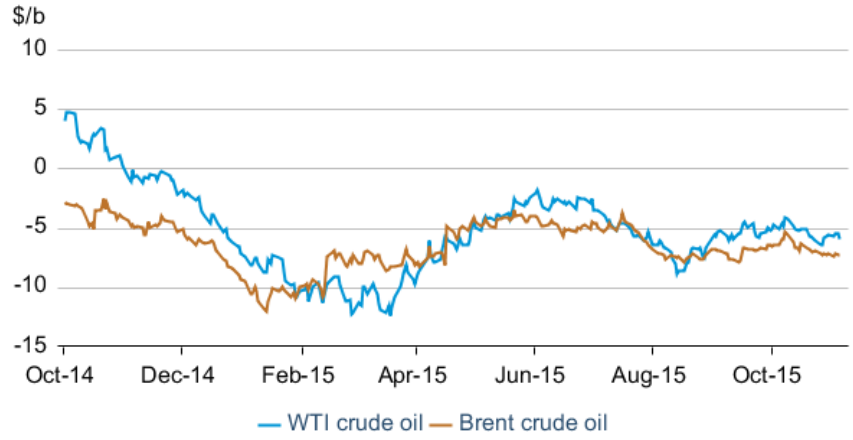
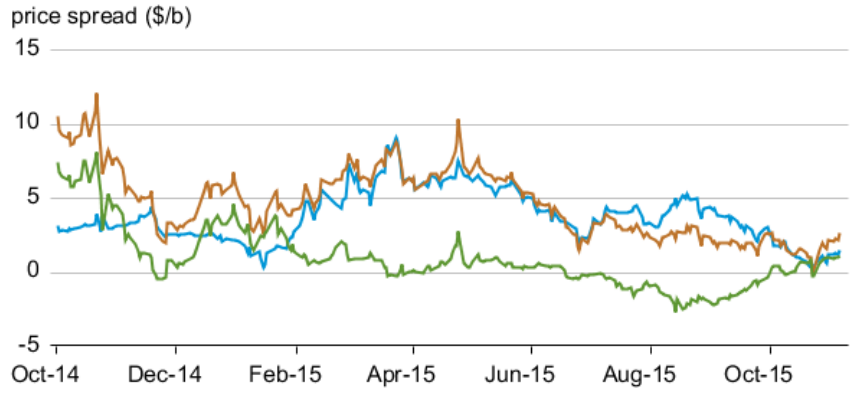
The price difference between the near-term futures contract and further-dated ones (contango) increased slightly for both Brent and WTI in October. The 1st-13th spread settled at -$7.32/b and -$5.95/b for Brent and WTI, respectively, on November 5, an increase in the discount of near month contracts of 78 cents/b and 90 cents/b, respectively **(Figure 2)**. Planned refinery maintenance in October contributed to lower refinery utilization in the United States, with 4-week average gross inputs falling 536 thousand b/d throughout the month. Crude oil inventories increased 22 million barrels in October, commensurate with a looser market during refinery maintenance season and lower near-term prices.

Figure 2. Crude oil front month - 13th month futures price spread



While total U.S. crude oil inventories built starting in mid-September, the increase in inventories was not uniform in all regions. Since the week ending September 11, commercial crude oil inventories built by 24 million barrels, or about 11%, in PADD 3 while inventories in Cushing, Oklahoma, declined by 1.3 million barrels, or about 3%. The large amount of crude oil inventories on the U.S. Gulf Coast may be pushing down crude oil prices in that area and making Cushing a more attractive destination for domestically produced barrels, which is supported by recent price spread movements. The Light Louisiana Sweet (LLS) - WTI Cushing crude oil spot price spread was $1.50/b on November 5, near its lowest level of the year **(Figure 3)**. The differential between WTI Cushing and WTI Midland was $1.10/b on November 5, recently turning positive for the first time since August. Although some amount of crude oil is contractually obligated to move on pipelines to the Gulf Coast each month, current price spreads may encourage incremental barrels to be stored in Cushing and could increase builds there in the near future.

Figure 3. U.S. crude oil price differentials



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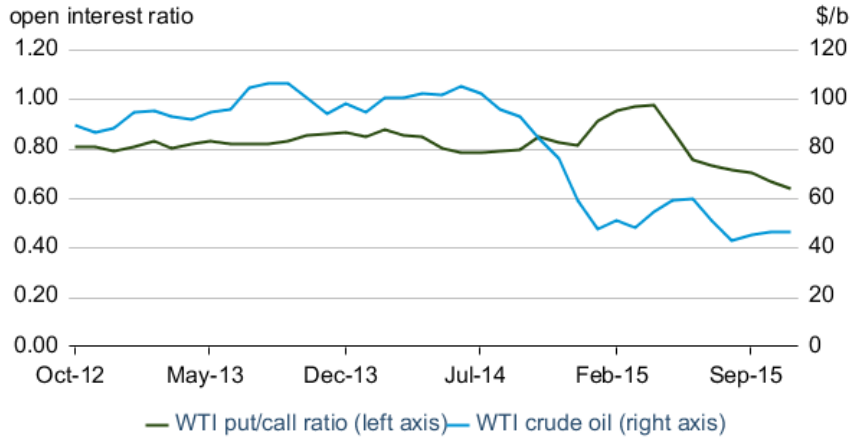
Open Interest Ratio: The monthly average ratio of open interest in put options compared to the open interest of call options traded on WTI contracts decreased from 0.70 in September to 0.67 in October, the sixth consecutive monthly decline **(Figure 4)**. The ratio can indicate market sentiment for crude oil prices, as it measures changes in the number of contracts outstanding for calls, which gain in value when crude oil prices increase, and puts, which gain in value when crude oil prices decline. The decline was driven by call option open interest increasing by 100,000 contracts more per month than put contracts over the past six months. While it's unclear who exactly the buyers and sellers are, higher call option open interest could indicate a shift in market sentiment and potentially higher expectations for upside price movements.

Figure 4. Monthly average aggregate WTI option open interest ratio



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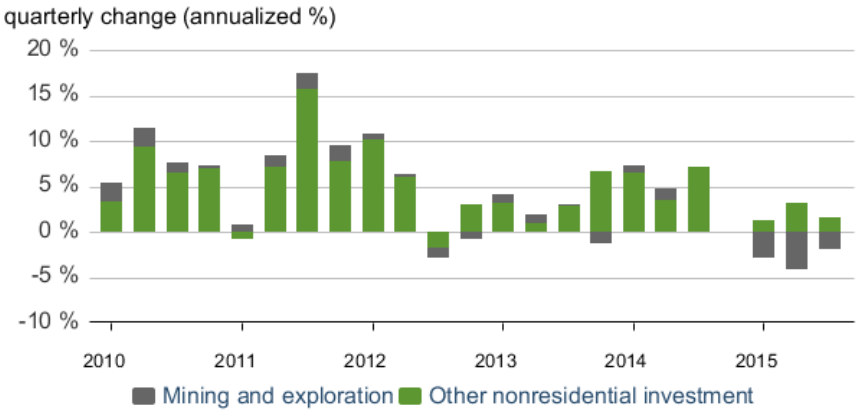
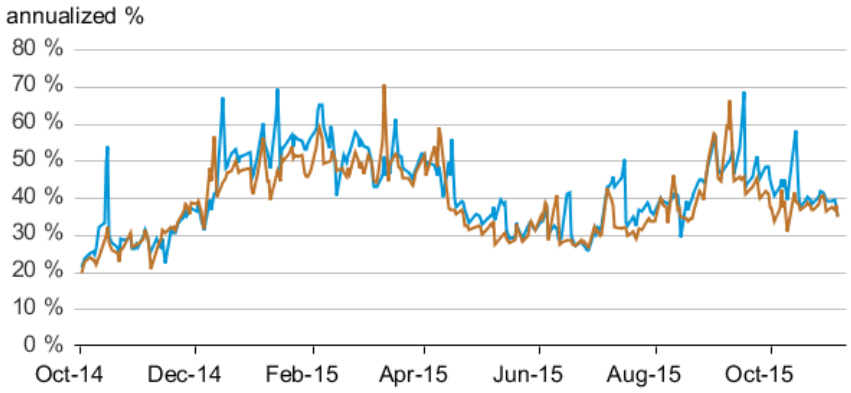
Oil Exploration and U.S. Gross Domestic Product: U.S. Gross Domestic Product grew at a 1.5% annualized rate in the third quarter, according to initial estimates by the Bureau of Economic Analysis, below expectations and below the second quarter's 3.9% growth. Investment in mining exploration, shafts, and wells totaled $75 billion, the lowest in real dollars for any quarter since 2009. This reduction contributed negatively to the change in nonresidential investment—which represents approximately 13% of U.S. GDP—for the third consecutive quarter **(Figure 5)**. Low oil prices remain a major factor in oil exploration and production firms' decisions to reduce capital expenditure. Third-quarter earnings statements from U.S. companies indicate further plans to reduce capital expenditure and sell assets to balance spending with lower cash flows until crude oil prices increase enough to make investments economic. These reductions could continue to pressure investment spending in the U.S. energy sector.

Figure 5. Contributions to percent change in nonresidential investment



Volatility: Implied volatility declined 8 percentage points for WTI since October 1 and decreased 2.1 percentage points for Brent over the same period **(Figure 6)**. The monthly average volatility for both contracts decreased from September to October by 7.1 and 8.8 percentage points for WTI and Brent, respectively. Despite the month over month decline, volatility remains elevated compared to the same time last year.

Figure 6. Crude oil implied volatility



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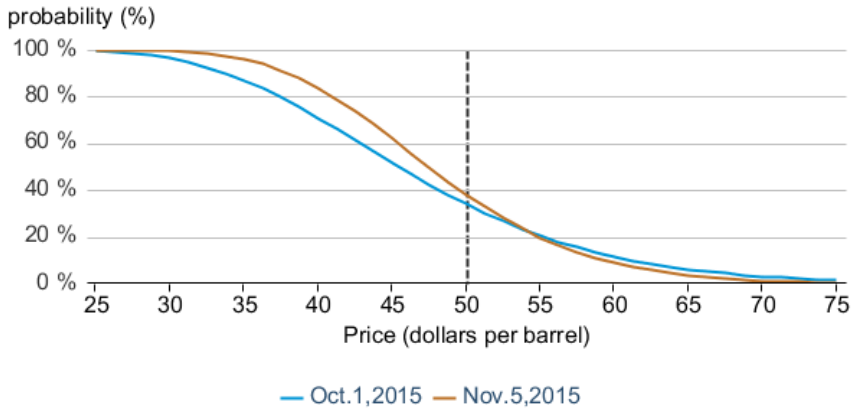
Market-Derived Probabilities: The February 2016 WTI futures contract averaged $48.16/b for the five trading days ending November 5 and has a 38% probability of exceeding $50/b at expiration. The same contract for the five trading days ending October 1had a 34% probability of exceeding $50/b **(Figure 7)**. Because Brent prices are higher than WTI prices, the probability of Brent futures contracts expiring above the same dollar thresholds is higher.

Figure 7. Probability of the February 2016 WTI contract expiring above price levels



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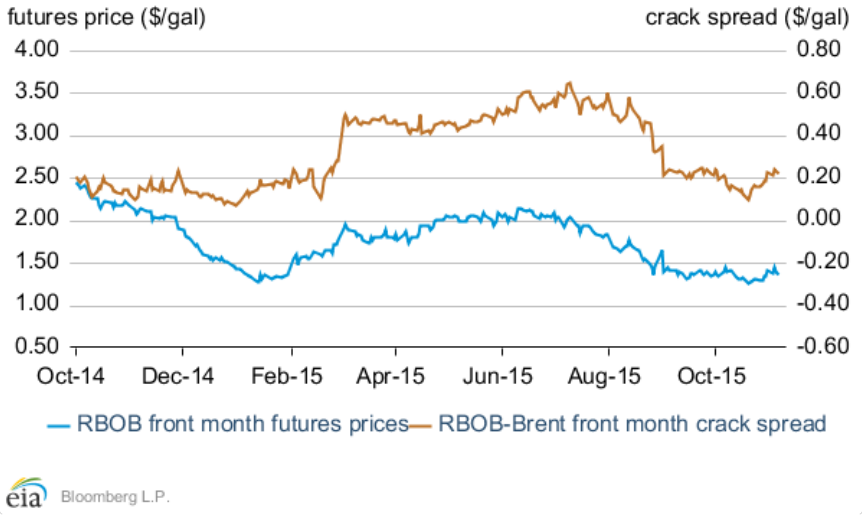
Petroleum Products

Gasoline prices: The reformulated blendstock for oxygenate blending (RBOB, the petroleum component of gasoline) front month futures price fell 1 cent per gallon (gal) from October 1 to November 5, settling at $1.36/gal **(Figure 8)**. The RBOB-Brent crack

spread settled at 22 cents/gal on November 5, a slight decrease of 1 cent/gal from on October 1.

Over the past two months, as gasoline consumption in the United States seasonally fell from summer-time highs, total U.S. gasoline inventories began to rise well above year-ago levels. As of October 30, total U.S. gasoline inventories were 215 million barrels, 12 million barrels more than this time last year, setting a new five-year high. In PADD 1B, which includes the New York Harbor delivery point of the RBOB futures contract, total gasoline inventories also set a new five-year high for October of 30 million barrels. Even though inventory levels are high, gasoline crack spreads remain near levels at this time last year. With further builds in inventories expected during the winter, gasoline prices could see declines in the coming months.

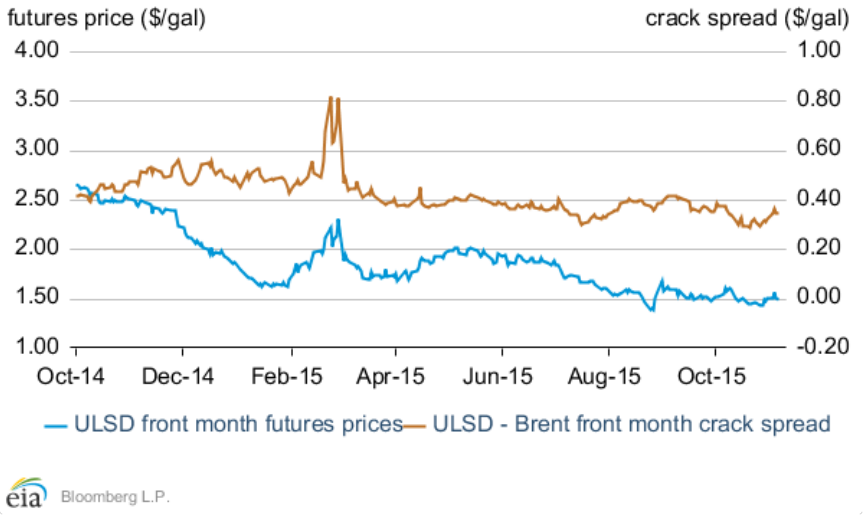
Figure 8. Historical RBOB futures prices and crack spread



Ultra-Low Sulfur Diesel prices: The front month futures price for the New York Harbor Ultra-Low Sulfur Diesel (ULSD) contract declined 3 cents/gal from October 1 to settle at $1.49/gal on November 5 **(Figure 9)**. The ULSD-Brent crack spread decreased 4 cents/gal over the same period to settle at 34 cents/gal. The average ULSD-Brent crack spread in October was 33 cents/gal, the lowest for that month since 2010.

The weak ULSD-Brent crack spread in October reflects the continued overhang of distillate inventories and the effects of weak global economic growth. In PADD 1B, distillate inventories increased each month since February, reaching 36.9 million barrels as of October 30 and putting current inventory in the Mid-Atlantic 13 million barrels above this time last year. The large amount of inventories available for the winter heating season reduces the changes of a significant price response if weather is colder than normal.

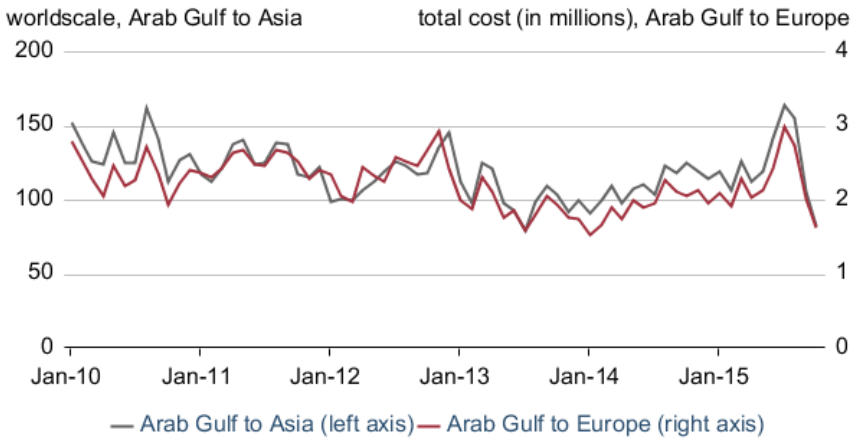
Figure 9. Historical ULSD futures price and crack spread



Clean tanker rates: The price to ship petroleum products on two routes originating from the Arab Gulf declined substantially since July. In July, the average Long Range 1 (LR1) clean tanker rate from the Arab Gulf to Asia reached the highest point since 2008 of Worldscale 164 **(Figure 10)**, indicating that rates were on average 64% higher than the published rates for that route. By October, the average rate fell to Worldscale 82, or 18% lower than the published rates and the lowest since 2009. Similarly, the LR1 clean tanker rate from the Arab Gulf to Europe cost on average a total of $2.97 million in July, the highest since 2008, and fell to an average $1.62 million in October, the lowest since 2014.

High tanker rates for these two routes earlier this year reflected the increased demand for petroleum products, particularly gasoline in Asia and diesel in Europe. However, because refineries in Europe, the Middle East, and Asia all increased refinery runs to take advantage of robust gasoline crack spreads, distillate inventory levels began to rise globally. Further, China began to export more distillate this year than it has in previous years because of lower-than-expected distillate consumption in China. Reports show that distillate inventories in European and Asian storage hubs reached several-year highs. With high distillate inventories and declines in the gasoline crack spread globally, the steep drop in tanker rates out of the Arab Gulf to Asia and Europe may be an indicator of lower product demand in those regions until inventories are worked off. Data for global petroleum product trade is lagged by several months; however, tanker rates can be viewed as a real-time indicator of product demand, assuming no significant changes to the number of ships in the market.

Figure 10. Clean tanker rates, Arab Gulf origin



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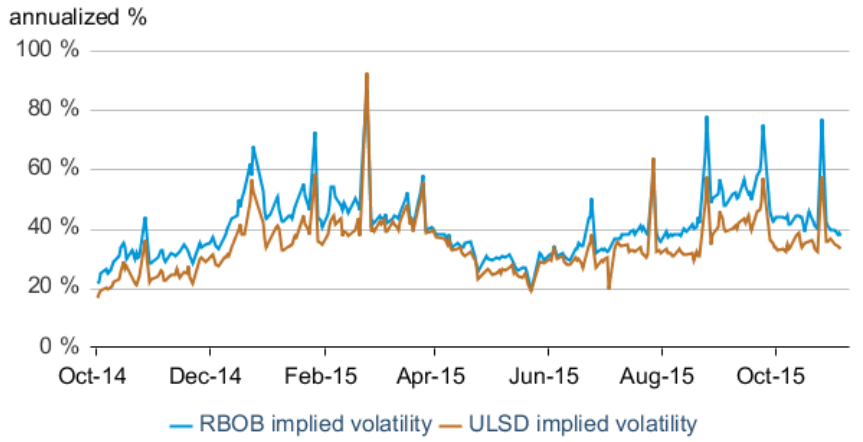
Volatility: Implied volatility for the RBOB front month futures contract declined 6 percentage points from October 1 to settle at 37.7% on November 5 **(Figure 11)**. The implied volatility for the ULSD front month futures contract settled at 33.3% on November 5, similar to the level on October 1. The average implied volatilities for both the RBOB and ULSD front month futures contracts in October declined month-over-month for the first time since May, reflecting decreased market uncertainty about future price movements.

Figure 11. RBOB and ULSD implied volatility



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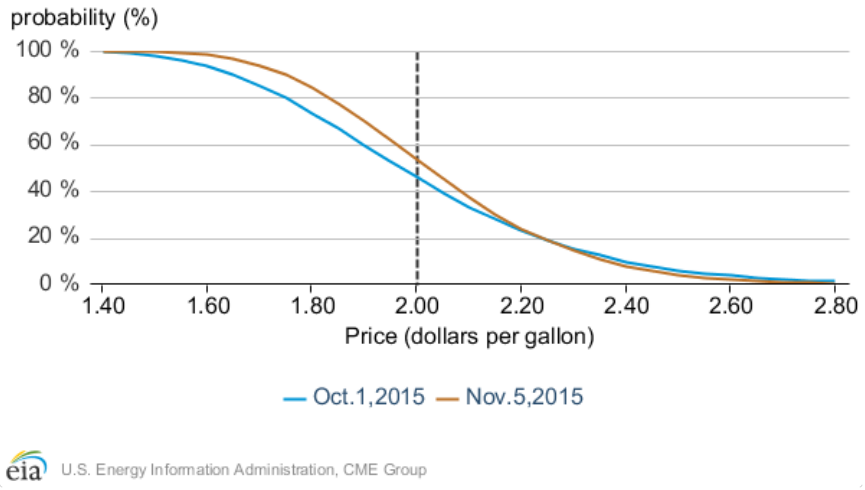
Market-Derived Probabilities: The February 2016 RBOB futures contract averaged $1.39/gal for the five trading days ending November 5 and has a 53% probability of exceeding $1.35/gal (typically leading to a retail price of $2.00/gal) at expiration. The

same contract for the five trading days ending October 1 had a 46% probability of exceeding $1.35/gal **(Figure 12)**.

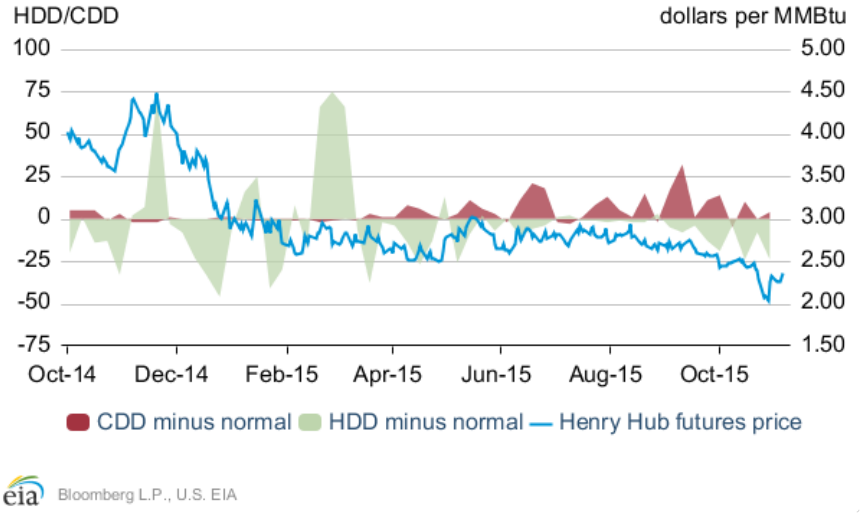
Figure 12. Probability of February 2016 retail gasoline exceeding different price levels at expiration



Natural Gas

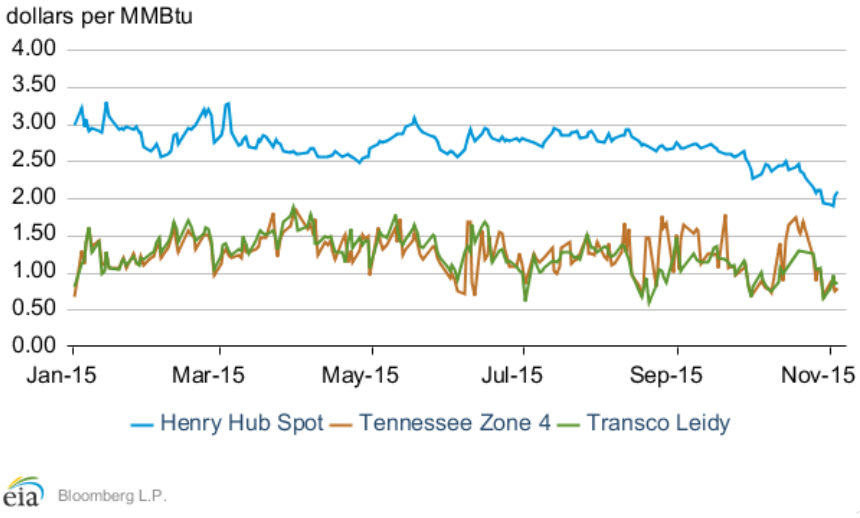
Prices: The front month Henry Hub futures price declined 7 cents per million British thermal unit (MMBtu) since October 1, settling at $2.36/MMBtu on November 5 **(Figure 13)**. Before the contract rolled to December delivery, the front month price reached its lowest point of the year of $2.03/MMBtu on October 28. Heating degree days (HDD) were below normal for the 10th consecutive week, with warmer temperatures implying reduced demand. The forecast for potentially warmer temperatures across much of the United States this winter may be lowering expectations for future natural gas consumption and weighing on prices. The latest monthly data also showed U.S. dry natural gas production increased to a record high of 76.5 billion cubic feet per day in August.

Figure 13. HDD minus normal and CDD minus normal



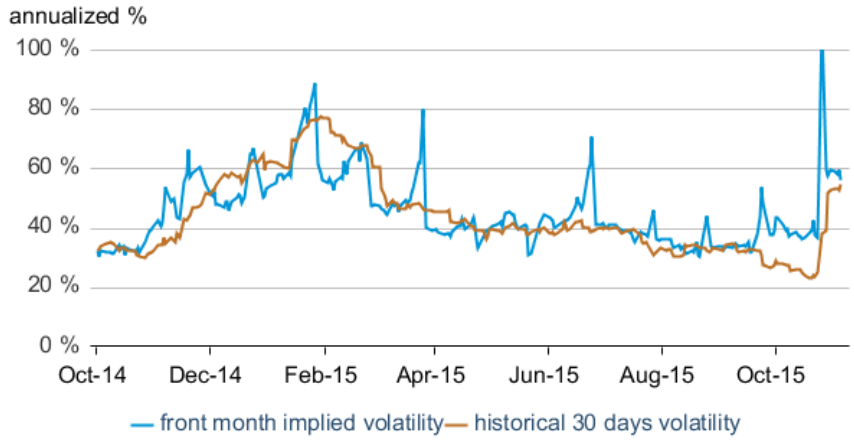
While lower natural gas prices could slow future production growth, not all regions in the United States are experiencing price declines. Natural gas prices in the Marcellus region, represented by the Tennessee Zone 4 and Transco Leidy spot prices, have not fallen by as much and remain close to their year-to-date averages. The Tennessee Zone 4 and Transco Leidy spot prices averaged $1.20/MMBtu and $0.98/MMBtu, respectively, from mid-October to November 5, only 9 cents/MMBtu and 31 cents/MMBtu below January 2015 through September 2015 averages **(Figure 14)**. The average Henry Hub natural gas spot price from mid-October to November 5 was 59 cents/MMBtu below its average from January 2015 through September 2015. This suggests that production in the Marcellus area may not be affected as much by lower natural gas prices compared to other parts of the country.

Figure 14. Marcellus area spot prices and Henry Hub



Volatility: Natural gas implied volatility typically begins to increase this time of year due to uncertainty associated with the impending winter heating season. However, the increase in volatility over the last few weeks was larger compared to previous years and likely also reflects price risk associated with robust supply and inventory levels. The implied volatility for the front month contract settled at 55.9% on November 5, 12.2 percentage points higher compared to October 1 **(Figure 15)**.

Figure 15. Natural gas historical and implied volatility



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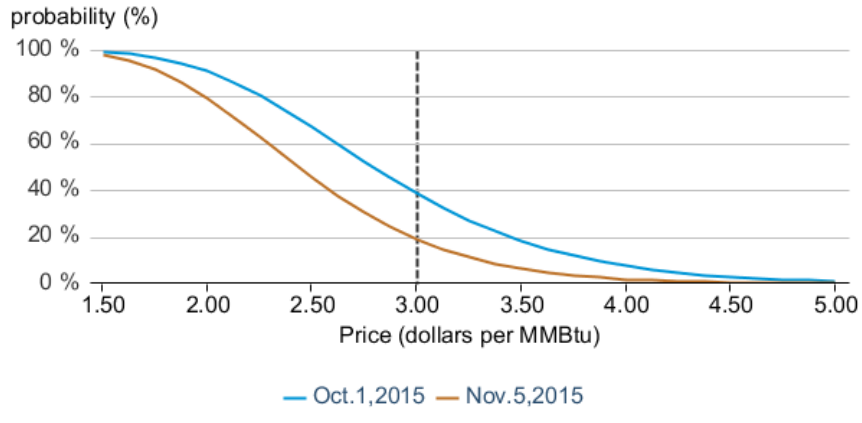
Market-Derived Probabilities: The February 2016 Henry Hub futures contract averaged $2.50/MMBtu for the five trading days ending November 1 and has a 19% probability of exceeding $3.00/MMBtu at expiration. The same contract for the five trading days ending October 1 had a 39% probability of exceeding $3.00/MMBtu **(Figure 16)**.

Figure 16. Probability of the January 2016 Henry Hub contract expiring above price levels



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